

# ENVIRONMENTAL ENGINEERING (EVG)

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## **EVG 5001 Biofilm Processes in Wastewater Treatment (3 crédits / 3 units)**

**Volet / Course Component:** Cours magistral / Lecture

## **EVG 5125 Statistical Methods in Hydrology (3 units)**

Concepts of probability and random variables applied to hydrology. Statistical distributions, their approximation and analysis. Statistical inference, including tests of significance and estimation theory. Linear and multivariate correlation and regression techniques. Data generation and simulation techniques for design of water-resource systems. Introduction to hydrologic and meteorologic time series. This course is equivalent to CIVJ 5601 at Carleton University.

**Course Component:** Lecture

## **EVG 5130 Wastewater Treatment Process Design (3 units)**

The physical, chemical and biological processes involved in the treatment of domestic and industrial wastes. Waste characteristics, stream assimilation, biological oxidation, aeration, sedimentation, anaerobic digestion, sludge disposal. This course is equivalent to ENVJ 5900 at Carleton University.

**Course Component:** Lecture

Previously CVG 5130.

## **EVG 5132 Unit Operations of Water Treatment (3 units)**

Unit operations and unit processes involved in the treatment of a water supply for various uses. Topics included are water quality, water microbiology, sedimentation, chemical treatment, disinfection, water chemistry, flocculation. This course is equivalent to ENVJ 5901 at Carleton University.

**Course Component:** Lecture

Previously CVG 5132.

## **EVG 5133 Solid Waste Management (3 units)**

Collection and disposal of solid wastes. Sanitary landfill, composting, incineration and other methods of disposal. Material and energy recovery. This course is equivalent to ENVJ 5906 at Carleton University.

**Course Component:** Lecture

Previously CVG 5133.

## **EVG 5134 Chemistry for Environmental Engineering (3 units)**

Dilute aqueous solution chemistry of water and wastewater treatment. Chemical kinetics and equilibrium. Carbonate, phosphate and chlorine chemistry. Precipitation and complex formation. Corrosion. Analytical techniques and applications. This course is equivalent to ENVJ 5907 at Carleton University.

**Course Component:** Lecture

Previously CVG 5134.

## **EVG 5137 Water and Wastewater Treatment Process Analysis (3 units)**

Mass balancing in complex systems. Reaction kinetics and kinetic data analysis: classical and computer based methods. Reactor design: ideal reactors and real reactors. Analysis of tracer tests. Interfacial mass transfer: common theories. Mass transfer models. This course is equivalent to ENVJ 5905 at Carleton University.

**Course Component:** Lecture

Previously CVG 5137.

## **EVG 5138 Advanced Water Treatment (3 units)**

Scope, limitations and design procedures for water treatment processes for the removal of toxic and non-standard contaminants. Current water treatment problems and regulations, activated carbon treatment, ion exchange, disinfection practices and oxidation via advanced oxidation processes (ozonation and UV oxidation), iron and manganese removal, recent developments in coagulation, membranes, air stripping. This course is equivalent to ENVJ 5902 at Carleton University.

**Course Component:** Lecture

Previously CVG 5138.

## **EVG 5139 Environmental Assessment of Civil Engineering Projects (3 units)**

Procedures and methods for systematic evaluation of the environmental impact of civil engineering projects including wastewater disposal systems, solid waste disposal systems, and water resource development systems. This course is equivalent to ENVJ 5700 at Carleton University.

**Course Component:** Lecture

Previously CVG 5139.

## **EVG 5179 Anaerobic Digestion (3 units)**

Advanced theoretical, biological, and practical aspects of anaerobic digestion processes. Principles to be applied to the design and application of conventional and advanced anaerobic processes used for treatment of municipal and industrial wastewaters. Topics to include microbiology and biochemistry fundamentals, techniques for monitoring anaerobic digestion performance, municipal sludge stabilization, anaerobic composting, anoxic/anaerobic bioremediation, Andrew's dynamic model. Design of the following: two-phase digestion; Downflow Stationary Fixed Film (DSFF) reactors; Upflow Anaerobic Sludge Blanket (UASB); Upflow Blanket Filter (UBF) reactors; and Anaerobic Sequencing Batch Reactors (ASBR). This course is equivalent to ENVJ 5908 at Carleton University.

**Course Component:** Lecture

Previously CVG 5179.

## **EVG 5182 Water Resources Management (3 units)**

Global water supply and demand; Integrated water resources management; Modeling and optimization of water resources systems; Reservoir Management; Uncertainty modeling; Climate Change and water; Decision under uncertainty.

**Course Component:** Lecture

## **EVG 5183 Mixing and Transport in Water Bodies (3 units)**

Typical models for selected water resources systems : Rivers, lakes, estuaries; Water quality parameters; Conservative parameters; Non conservative parameters; Laminar and turbulent flows; Dispersion; Pollution sources; Modeling; Simplified (integral) models; Dilution models; Three Dimensional models; Advection-Diffusion Equation; Analytical solution; Numerical solution; Non-conservative transport and Multi-component systems; Modeling approaches based on conservative and non-conservative transport and kinetics; Certain water quality parameters (Temperature, Salinity, etc.).

**Course Component:** Lecture

## **EVG 5203 Hazardous and Radioactive Waste Management (3 units)**

This course is equivalent to ENVE 5203 at Carleton University.

**Course Component:** Lecture

**EVG 5212 Climate Change Impacts on Water Resources (3 units)**

Spatiotemporal distribution of water and its impact on human activities, including domestic and municipal consumption, hydropower generation, rain-fed and irrigated agriculture, design and operation of sewer systems, floodplain zoning, navigation, etc. Critical assessment of methodologies for climate change impacts estimation. Theoretical knowledge and hands-on application experience needed to perform climate change analysis on a water resources system.

**Course Component:** Lecture

**EVG 5301 Soil and Water Conservation Engineering (3 units)**

The design, water quality and climate change impacts of soil and water conservation systems. Topics include: urban storm water management (including LID) erosion control practices, subsurface and surface drainage systems and irrigation technologies.

**Course Component:** Lecture

**EVG 5302 Decentralized Wastewater Management (3 units)**

This course covers fundamental principles and practical design applications of decentralized wastewater treatment for domestic and industrial sources. Topics include: management of decentralized wastewater systems, pre-treatment systems, soil infiltration systems, advanced onsite technologies, constructed wetlands, alternative collection systems, wastewater reuse and septage management.

**Course Component:** Lecture

**EVG 5331 Sludge Utilization and Disposal (3 units)**

Introduction to sludge processing technology and procedures to be used in the planning and design of sludge treatment processes. Evaluate the economics and performance of sludge unit process operations. Selection of methods for the final disposition of sludge. This course is equivalent to ENVJ 5902 at Carleton University.

**Course Component:** Lecture

**EVG 5333 Research Methodology (3 units)**

Key components and strategies required to build a robust scientific research program in environmental engineering including research questions, literature review, experiment design, data interpretation, scientific manuscripts, public speaking, ethics, and plagiarism.

**Course Component:** Lecture

**EVG 5800 Seminar for Master's Candidates in Environmental Engineering (1 crédit)**

Ce cours est équivalent à ENVE 5800 à la Carleton University.

**Volet :** Recherche

**EVG 5801 Seminar for Doctoral Candidates in Environmental Engineering (3 crédits)**

Ce cours est équivalent à ENVE 7800 à la Carleton University.

**Volet :** Recherche

**EVG 6001 Projet en génie de l'environnement / Environmental Engineering Project (6 crédits / 6 units)**

Ce cours est équivalent à ENVE 5900 à la Carleton University. / This course is equivalent to ENVE 5900 at Carleton University.

**Volet / Course Component:** Recherche / Research

**EVG 6108 Directed Studies I (3 units)**

This course is equivalent to ENVE 5906 at Carleton University.

**Course Component:** Research

**EVG 6109 Directed Studies II (3 units)**

This course is equivalent to ENVE 5907 at Carleton University.

**Course Component:** Research

**EVG 6300 Special Topics in Environmental Engineering (3 units)**

**Course Component:** Lecture

**EVG 6301 Special Topics in Environmental Engineering (3 units)**

This course is equivalent to ENVE 5701 at Carleton University.

**Course Component:** Lecture

**EVG 6302 Special Topics in Environmental Engineering (3 units)**

This course is equivalent to ENVE 5702 at Carleton University.

**Course Component:** Lecture

**EVG 6303 Special Topics in Environmental Engineering (3 units)**

**Course Component:** Lecture

**EVG 6304 Special Topics in Environmental Engineering (3 units)**

**Course Component:** Lecture

**EVG 6508 Études dirigées I (3 crédits)**

**Volet :** Cours magistral

**EVG 6509 Études dirigées II (3 crédits)**

**Volet :** Cours magistral

**EVG 7001 Topics in Environmental Engineering (3 crédits / 3 units)**

This course is equivalent to ENVE 5701 at Carleton University.

**Volet / Course Component:** Cours magistral / Lecture

**EVG 7002 Topics in Environmental Engineering (3 crédits / 3 units)**

This course is equivalent to ENVE 5702 at Carleton University.

**Volet / Course Component:** Cours magistral / Lecture

**EVG 7003 Topics in Environmental Engineering (3 crédits / 3 units)**

This course is equivalent to ENVE 5703 at Carleton University.

**Volet / Course Component:** Cours magistral / Lecture

**EVG 7004 Topics in Environmental Engineering (3 crédits / 3 units)**

This course is equivalent to ENVE 5704 at Carleton University.

**Volet / Course Component:** Cours magistral / Lecture

**EVG 7005 Topics in Environmental Engineering (3 crédits / 3 units)**

This course is equivalent to ENVE 5705 at Carleton University.

**Volet / Course Component:** Cours magistral / Lecture

**EVG 7101 Air Pollution Control Process (3 units)**

Air quality and pollution; definitions, measurement and monitoring methods. Criteria pollutants, air toxics, particulate matter, secondary pollutants. Pollutant formation mechanisms. Major sources and control methods. Meteorology and principles of dispersion modelling. Principles of receptor modelling. Indoor air quality.

**Course Component:** Lecture

Previously CVG 7101.

**EVG 7104 Indoor Air Quality (3 units)**

This course is equivalent to ENVE 5104 at Carleton University.

**Course Component:** Lecture

**EVG 7105 Atmospheric Aerosols (3 units)**

Atmospheric aerosol characterization and size distribution, theoretical fundamentals of physical and chemical processes that govern formation and transformation of aerosols in the atmosphere such as nucleation, coagulation, condensation/evaporation, and aerosol thermodynamics; interactions between aerosols and climate, aerosol sampling and measurement. This course is equivalent to ENVE 5105 at Carleton University.

**Course Component:** Lecture

**EVG 7106 Atmospheric Chemical Transport Modelling (3 units)**

Fundamentals of Eulerian atmospheric modelling; overview of global and regional atmospheric models, basic principles of numerical methods used in air quality models; applications of air quality models; uncertainty and sensitivity analysis in air quality modelling. This course is equivalent to ENVE 5106 at Carleton University.

**Course Component:** Lecture

**EVG 7132 Sludge Treatment and Disposal (3 units)**

Aspects of sludge treatment, management, and disposal; sludge generation and characterization, thickening, preliminary treatment processes, aerobic and anaerobic digestion, lime stabilization, conditioning, dewatering, composting, land application and other disposal options, and thermal processes. This course is equivalent to ENVE 5205 at Carleton University.

**Course Component:** Lecture

**EVG 7134 Resource Industry Waste Management (3 units)**

Application of geotechnique and hydraulics to management of resource extraction residuals such as tailings, waste rock, and sludge from hard rock mines and bitumen extraction operations. Geotechnique of conventional and high density tailings disposal. Pipeline transport of concentrated suspensions. Closure technologies for mine waste impoundments. This course is equivalent to ENVE 5204 at Carleton University.

**Course Component:** Lecture

**EVG 7143 Advanced Ultraviolet Processes (3 units)**

Fundamentals and applications of ultraviolet (UV) light-based processes for water and wastewater treatment; principles of photochemistry and photobiology, methods of UV dose determination, UV disinfection of microorganisms, advanced oxidation processes, and design of UV disinfection systems and reactors. This course is equivalent to ENVE 5003 at Carleton University.

**Course Component:** Lecture

**EVG 7144 Advanced Wastewater Treatment (3 units)**

Fundamentals, applications, and design of biological, physical, and chemical treatment processes employed for advanced treatment of domestic and industrial wastewater. Reuse applications and guidelines. This course is equivalent to ENVE 5004 at Carleton University.

**Course Component:** Lecture

**EVG 7161 Traffic Related Air Pollution (3 units)**

Pollutant formation, emission characterization, emission control technology and emission modeling from motor vehicles. Dispersion and receptor modeling for conservative pollutants in urban microenvironments. Personal exposure and health risk assessment.

**Course Component:** Lecture

Previously CVG 7161.

**EVG 7162 Air Quality Modelling (3 units)**

Dispersion modeling for simple and complex sources and complex terrain. Physical and chemical transformations for pollutants in the atmosphere. Urban and regional air pollution modeling for reactive pollutants. The urban air shed model. Regional air quality modeling case studies.

**Course Component:** Lecture

Previously CVG 7162.

**EVG 7163 Case Studies in Hydrogeology (3 units)**

Development of a conceptual model; chemistry, geology and hydrology, site characterization, initial and boundary conditions. Application of industry-recognized computer codes to model flow and contaminant transport at a particular site. Evaluation of remedial alternatives at a site. Modeling of the more common remediation technologies. This course is equivalent to ENVE 5302 at Carleton University.

**Course Component:** Lecture

**EVG 7164 Hazardous and radioactive Wastes (3 units)**

Classification of hazardous, radioactive and mixed wastes, hazardous waste treatment processes, wastes generated in the nuclear fuel cycle, radioactive waste classification, radioactive waste treatment and management of residuals, engineered systems for long-term isolation and disposal, mixed waste management. This course is equivalent to ENVE 5203 at Carleton University.

**Course Component:** Lecture

**EVG 7200 Climate Change and Engineering (3 units)**

This course will cover broad environmental and climate change issues affecting engineered systems.

**Course Component:** Lecture

**EVG 7201 Geo-Environmental Engineering (3 units)**

This course is equivalent to ENVE 5201 at Carleton University.

**Course Component:** Lecture

**EVG 7202 Contaminant Fate Mechanisms (3 units)**

This course is equivalent to ENVE 5202 at Carleton University.

**Course Component:** Lecture

**EVG 7301 Contaminant Hydrology (3 units)**

This course is equivalent to ENVE 5301 at Carleton University.

**Course Component:** Lecture

**EVG 7303 Multiphase Flow in Soils (3 units)**

This course is equivalent to ENVE 5303 at Carleton University.

**Course Component:** Lecture

**EVG 7401 Environmental Impact Assessment of Major Projects (3 units)**

This course is equivalent to ENVE 5401 at Carleton University.

**Course Component:** Lecture

**EVG 7402 Finite Elements in Field Problems (3 units)**

This course is equivalent to ENVE 5402 at Carleton University.

**Course Component:** Lecture

**EVG 9998 Proposition de thèse et examen de synthèse / Thesis Proposal and Comprehensive Examination**

**Volet / Course Component:** Recherche / Research